

solution of dimethyl polysiloxane in ethanol and isopropyl alcohol, as shown on the attached "Material Safety Data Sheet" printed from the manufacturer's website.

The amendments to claims 36 and 37 introduce into the claims words abbreviated in the claims as originally presented. The full name of the acronym NASBA is set forth at page 5, line 10. Lithium tetrachloroacetate is set forth at page 6, line 26.

For the record, Applicants note that none of the amendments narrow or are intended to narrow the scope of the claims; Applicants therefore believe they are entitled to the full scope of equivalents to each of the claims.

### **III. The Office Action, and Response Thereto**

The Action rejects the claims on several grounds. For the Examiner's convenience, they are addressed in the order in which they appear.

#### **A. Rejections under 35 U.S.C. § 112, second paragraph**

1. Claims 36 and 37 are rejected 35 U.S.C. § 112, second paragraph as being indefinite. According to the Action, claim 36 is indefinite for reciting the acronym "NASBA" and claim 37 is indefinite for reciting "TCA". Although Applicants believe both claims would be clear to a person of skill in the art, the full name abbreviated in the acronyms have been inserted as helpfully suggested by the Action. The amendments are believed to obviate the rejection. Reconsideration and withdrawal of the rejection is respectfully requested.

2. Claims 13, 17, and 43 are rejected for use of the trademarked term Gel Slick™. According to the Action, the use of a trademarked name is indefinite because the name identifies the source of goods rather than the goods associated with the trademark. The trademarked product referred to, Gel Slick™, is a solution of dimethyl polysiloxane in ethanol and isopropyl alcohol, as shown on the attached "Material Safety Data Sheet" printed from the manufacturer's website. Applicants have therefore amended the claim to refer to dimethyl polysiloxane. The amendment is believed to obviate the rejection.

**B. Rejection of the Claims under 35 U.S.C. § 102(b)**

Claims 15-17, 23-26, 28-34, 38-44, and 46-47 are rejected under 35 U.S.C. § 102(b) as anticipated by Stavrianopoulos et al., U.S. Patent 4,994,373 (hereafter, "Stravrianopoulos"). Action, at bottom of page 3 to top of page 5. According to the Action, Stravrianopoulos teaches contacting a solid support with a non-stick coating, which "is a silanizing reagent consisting of silane. (col. 8, lines 23-27)." Action, at page 4. Applicants traverse.

The Action's finding of anticipation rests on the premise that Stravrianopoulos teaches a non-stick coating. This belief is founded on a perhaps understandable confusion between the gamma-aminopropyltriethoxysilane discussed in Stravrianopoulos and silane, as recited in, e.g., claim 15. But, in fact, gamma-aminopropyltriethoxysilane is neither silane nor a non-stick coating as recited by the claims.

According to the standard reference KIRK-OTHMER ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY, (Kroschwitz ed.), John Wiley & Sons New York (4th ed., 1997) (hereafter, "Kirk-Othmer"):

Silane . . . , SiH<sub>4</sub>, is the simplest silicon compound and provides the basis of nomenclature for all silicon chemistry. Compounds are named as derivatives of silane. The substituents, whether inorganic or organic, are prefixed. . . . Two or more substituents are listed alphabetically . . .

The inorganic silanes of commercial importance include silane, . . .

Arkles, B., *in* vol. 22, Kirk-Othmer, pages 38-9 (for the Examiner's convenience, the cited pages of Kirk-Othmer are provided with this Amendment). Thus, "silane" refers to a particular compound, while phrases such as "a silane" can refer to silane or to a derivative thereof.

The specification makes clear that some silanes, including silane and the specific silane derivatives recited in claims 15 and 43, are non-stick coatings. The

specification also makes clear, however, that some silanes can be derivatized with a reactive functional group that permits them to bind a desired reagent, for example, a tag. See, specification, at page 12, lines 14-27. In this regard, the specification states: "Aminoalkylsilanes and hydroxyalkylsilanes can be used to functionalize a variety of surfaces, such as glass surfaces." Id., at lines 19-20. Thus, aminoalkylsilanes, far from being a non-stick reagent, are "sticky" reagents which can be used precisely for the purpose of binding to glass or another surface a compound reactive with the particular functional amino group with which the silane is derivatized.

The Action's argument is that Stravrianopoulos uses a non-stick coating, gamma-aminopropyltriethoxysilane. But, as is evident from its name, gamma-aminopropyltriethoxysilane is an aminoalkylsilane. As just noted, aminoalkylsilanes are identified in the specification as derivatized silanes functionalized to permit them to bind other reagents to a surface. And that is exactly what Stravrianopoulos uses gamma-aminopropyltriethoxysilane for: the glass surface has the compound applied (column 8, lines 23-27), it is incubated with the compound (*id.*, lines 27-30), and then washed and dried (*id.*, lines 30-32). Stravrianopoulos explains: "The resulting treated glass surface will now have available alkylamine thereon suitable for immobilizing or fixing any negatively charged polyelectrolytes applied thereto." Stravrianopoulos, at column 8, lines 32-35. Thus, Stravrianopoulos makes clear that the alkylamine group provided by the gamma-aminopropyltriethoxysilane, far from being a non-stick coating, binds polyelectrolytes to the treated glass surface.

In short, the rejection is based on a confusion between the specific compound "silane" (which the specification identifies as a non-stick coating) and one of its functionalized derivatives, of a type that the specification identifies as suitable for functionalizing surfaces. The rejection further mistakes this functionalized derivative for a non-stick coating and finds that the use of this "sticky" derivative anticipates the use of the non-stick parent compound. As is evident from the discussion above, however, silane and gamma-aminopropyltriethoxysilane are different chemical entities with different

properties. The use of gamma-aminopropyltriethoxysilane in the Stravrianopoulos patent, therefore, does not anticipate the claims.

Finally, the rejection of the dependent claims as anticipated rests on the assumption that Stravrianopoulos teaches the use of gamma-aminopropyltriethoxysilane as a non-stick coating. Since gamma-aminopropyltriethoxysilane is not a non-stick coating (and, in fact, is used for precisely the opposite purpose in the Stavrianopoulos patent), the rejection of the other claims, which rests on this incorrect belief, is unsupported.

In summary, the rejection of the claims as anticipated rests on the incorrect belief that silane and gamma-aminopropyltriethoxysilane are both non-stick coatings. As shown above, silane is a non-stick coating while gamma-aminopropyltriethoxysilane is a reactive compound used to bind reagents to surfaces to which they otherwise might not bind. The rejection should be reconsidered and, upon reconsideration, withdrawn.

### **C. Rejection of the Claims as Obvious Under 35 U.S.C. § 103(a)**

#### **1. Rejection over Schniepelsky, Douglas and Ness**

The Action rejects claims 1-14, 18-22, 27, 37, and 45 under 35 U.S.C. § 103(a) as obvious over Schniepelsky, U.S. Patent 5,229,297 (hereafter, "Schniepelsky" or "the '297 patent"), in view of Douglas, U.S. Patent 5,556,748 (hereafter, "Douglas" or "the '748 patent"), and further in view of Ness et al., Nucleic Acids Res. 5143-51 (1991) (hereafter, "Ness"). Action, at pages 5-7. Applicants traverse.

The Action concedes that the '297 patent does not teach the use of a non-stick coating on a solid support. The Action finds this teaching in Douglas, which is characterized as teaching the use of a "non-stick material consisting [] of silane." Action, at page 6. The place referred to in Douglas is column 2, lines 23-37. A review of Douglas at the place cited reveals that Douglas is there characterizing a prior patent as teaching a method for binding polynucleotide probes to a solid support such as glass by synthesizing a polynucleotide on the solid support. Douglas states: "(The glass described

is amine-functionalized with a silane derivative)." Thus, on its face, Douglas does not teach the use of non-stick coating. Rather, it teaches the use of an amine-derivatized silane to bind reagents to a surface to which they would otherwise presumably not bind.

As discussed in section III B of this Amendment, above, "silane" refers to a specific compound, and the specification distinguishes between the compound silane, which provides a non-stick coating, and an amine-derivatized silane, which does not. Douglas therefore does not teach the use of a non-stick coating. Moreover, the rejection mistakes the compound "silane" as recited in the claims under examination for the silane derivative which provides an amino group in Douglas. Neither Douglas nor the '297 patent teach the use of a non-stick coating, as claimed. Nor would there be a motivation to modify Douglas to use a silane that would provide a non-stick coating, since that would destroy the purpose for which the silane derivative is used in the reference. As the Examiner is aware, "the proposed modification cannot render the prior art unsatisfactory for its intended purpose." MPEP § 2143.01 (8th ed., August 2001), at page 2100-124).

Ness does not rectify this deficiency. Ness is cited only to provide a teaching regarding the use of a chaotrope to combine with the other references. It therefore does not provide the element of a non-stick coating.

The claims are therefore not obvious over the '297 patent, Douglas, or Ness, either individually or in combination. The rejection is founded on a fundamental error regarding the identity of "silane" as recited in the claims and a silane derivative which provides a reactive amino group. The rejection should therefore be reconsidered, and withdrawn.

## **2. Rejection over Stravrianopoulos and Stapleton**

Claims 35 and 36 are rejected under 35 U.S.C. § 103(a) as obvious over Stavrianopoulos in view of Stapleton, U.S. Patent 5,436,129. According to the Action, Stavrianopoulos teaches coating a solid support with a non-stick coating, while Stapleton teaches amplification of a polynucleotide. Action, at pages 7-8. Applicants traverse.

This rejection rests on the premise that Stavrianopoulos teaches the use of a non-stick coating. This, in turn, is based on the premise that the gamma-aminopropyltriethoxysilane used in the reference is a non-stick coating. As extensively discussed in section III B., above, this rest on a confusion between "silane" as recited in the claims, and gamma-aminopropyltriethoxysilane, a derivative of silane which is functionalized with an amino group and used to bind other reagents to the solid support on which the gamma-aminopropyltriethoxysilane has bound. As shown above in connection with the rejections under 35 U.S.C. §102(b), silane is a non-stick coating while gamma-aminopropyltriethoxysilane is a reactive compound used to bind reagents to surfaces to which they otherwise might not bind. Accordingly, the characterization of Stavrianopoulos is premised on an error.

The Stapleton reference does not make up this deficiency. Stapleton is cited merely to show amplification of polynucleotides. The Action does not contend that Stapleton teaches the use of a non-stick coating.

Accordingly, neither Stavrianopoulos nor Stapleton, alone or in combination, teaches or suggests the invention. The rejection should be reconsidered and, upon reconsideration, withdrawn.

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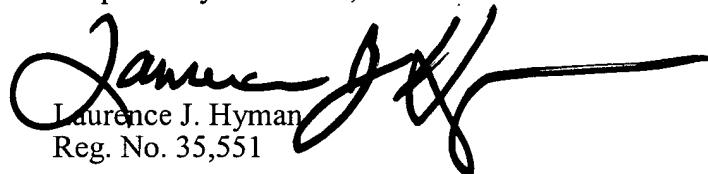
PATENT

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 415-576-0200.

Respectfully submitted,



Laurence J. Hyman  
Reg. No. 35,551

TOWNSEND and TOWNSEND and CREW LLP  
Two Embarcadero Center, 8<sup>th</sup> Floor  
San Francisco, California 94111-3834  
Tel: 415-576-0200  
Fax: 415-576-0300  
LJH:ljh

Attachments: GelSlick™ Material Safety Data Sheet  
Kirk-Othmer Encyclopedia of Chemical Technology, Vol. 22, pages 38-9

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**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

13. (Amended) The method of claim 1, wherein the non-stick coating material is selected from the group consisting of silane, dimethylchlorosilane and dimethyl polysiloxane [Gel Slick™].

17. (Amended) The method of claim 15, wherein the non-stick coating material is selected from the group consisting of silane, dimethylchlorosilane and dimethyl polysiloxane [Gel Slick™].

36. (Amended) The method of claim 35, wherein the polynucleotide is amplified by a procedure selected from the group consisting of polymerase chain reaction, ligase chain reaction, strand displacement amplification, transcription mediated amplification, and [NASBA] nucleic acid sequence-based amplification ("NASBA").

37. (Amended) The method of claim 31, wherein the denaturant is selected from the group consisting of guanidine, sodium thiocyanate, urea, and lithium [TCA] tetrachloroacetate.

43. (Amended) The apparatus of claim 42, wherein the silanizing agent is selected from the group consisting of silane, dimethylchlorosilane and dimethyl polysiloxane [Gel Slick™].



Product Name: Gel Slick® Solution

## MATERIAL SAFETY DATA SHEET

This document has been prepared to meet the requirements of the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200; the EC Directive, 91/155/EC and other regulatory requirements.

### 1. Company and Product Identification

BioWhittaker Molecular Applications  
191 Thomaston Street  
Rockland, ME 04841 (U.S.A.)

BioWhittaker Molecular Applications ApS  
1, Risingej  
DK-2665 Vallensbaek Strand  
Denmark

45 (Denmark) 43-56-74-00

**General Information:**  
(800) 521-0390  
(207) 594-3400

**Chemical Name:** Alcohol Solutions  
**Trade Name:** Gel Slick® solution

### EMERGENCY TELEPHONE NUMBER:

CHEMTREC: (800) 424-9300 (USA & Canada)  
(202) 483-7616 (All Other Countries)

### 2. Composition/Information on Ingredients

Ingredient Name	CAS #	% Ingredients	EC Symbol & Risk Phrases
Ethanol	64-17-5	< 92	F, R11
Isopropyl alcohol (IPA)	67-63-0	< 2	F, R11
Dimethyl Polysiloxane	63148-62-9	< 5	F, R11

### 3. Hazards Identification

#### Emergency Overview:

- Flammable liquid, clean, colorless.

**Potential Health Effects:** Irritating to eyes, skin and upper respiratory tract. Isopropyl alcohol may produce allergic contact dermatitis in sensitized individuals.

### 4. First Aid Measures

- Eyes** : Flush with water for at least fifteen minutes. If irritation occurs and persists, contact a medical doctor.  
**Skin** : Wash with plenty of soap and water. Get medical attention if irritation occurs and persists.  
**Inhalation** : Remove to fresh air. If breathing difficulty or discomfort occurs and persists, obtain medical attention.  
**Ingestion** : Drink 1 or 2 glasses of water and induce vomiting by touching the back of the throat with a finger or by giving syrup of ipecac. Never give anything by mouth to an unconscious person. Contact a medical doctor.  
**Note to Medical Doctor :** Gel Slick solution is anticipated to be moderately irritating to the eyes and upper respiratory tract. Treatment is controlled removal of exposure with symptomatic and supportive care.



KIRK-OTHMER

# ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY

FOURTH EDITION

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VOLUME 22

SILICON COMPOUNDS  
TO  
SUCCINIC ACID AND SUCCINIC ANHYDRIDE



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**JOHN WILEY & SONS**

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29. *Inorg. Synth.* 1, 38 (1939).
30. *Feasibility of the Silane Process for Producing Semiconductor Grade Silicon*, Jet Propulsion Laboratory Contract 954334, June 1979.
31. P. K. Basu, Ph.D. dissertation, *Development of a Process for the Manufacture of Silicone Tetrachloride from Rice Hulls*, University of California, Berkeley, 1972.
32. U.S. Pat. 3,173,758 (Mar. 16, 1965), R. N. Secord (to Cabot Corp.).
33. L. J. White and G. L. Duffy, *Ind. Eng. Chem.* 3, 235 (1959).

WARD COLLINS  
Dow Corning Corporation

## SILANES

The properties and applications of commercially important hydride functional silanes, ie, compounds having a Si-H bond; halosilanes, ie, compounds having a Si-X bond; and organosilanes, ie, compounds having a Si-C bond, are discussed herein. Compounds having Si-OSi bonds are called siloxanes or silicones. Those having a Si-OR bond are called silicon esters. Siloxanes and silicon esters are discussed elsewhere in the *Encyclopedia* (see SILICON COMPOUNDS, SILICON ESTERS; SILICON COMPOUNDS, SILICONES).

Silane [7803-62-5],  $\text{SiH}_4$ , is the simplest silicon compound and provides the basis of nomenclature for all silicon chemistry (1). Compounds are named as derivatives of silane. The substituents, whether inorganic or organic, are pre-fixed. Examples are trichlorosilane [10025-78-2],  $\text{HSiCl}_3$ ; disilane [1590-87-0],  $\text{H}_3\text{SiSiH}_3$ ; methyldichlorosilane [75-54-7],  $\text{CH}_3\text{SiHCl}_2$ ; methylsilane [992-94-9],  $\text{CH}_3\text{SiH}_3$ ; diethylsilane [542-91-6],  $(\text{C}_2\text{H}_5)_2\text{SiH}_2$ ; and triethylsilane [617-86-7],  $(\text{C}_2\text{H}_5)_3\text{SiH}$ . Two or more substituents are listed alphabetically, adhering to the following rules: substituted organic moieties are named first, followed by simple organic fragments; alkoxy substituents are named next, followed by acyloxy, halogen, and pseudohalogen groups. For example, ethylmethylethoxysilane [68414-52-8],  $\text{C}_2\text{H}_5(\text{CH}_3)\text{SiH}(\text{OC}_2\text{H}_5)$ , and 3-chloropropylmethylchlorosilane [33687-63-7],  $\text{ClCH}_2\text{CH}_2\text{CH}_2\text{SiH}(\text{CH}_3)\text{Cl}$ , are correct. The complete rules for nomenclature are available (2).

### Inorganic Hydride Functional Silanes

Hydride functional silanes are sometimes simply referred to as silanes. The classic work in the field was completed in the early 1900s and involved the study of silane and higher binary silanes,  $\text{Si}_n\text{H}_{2n+2}$ , by means of precision vacuum techniques (3). Only a few of the thousands of hydride functional silanes reported have any commercial significance. These include inorganic silanes, organic silanes, and polymeric siloxanes. Despite the small number, a wide range of applications has developed for such compounds, eg, in the manufacture of high purity and electronic-grade silicon metal (see SILICON AND SILICON ALLOYS, PURE SILICON) and in epitaxial silicon deposition (see ELECTRONIC MATERIALS; INTEGRATED CIRCUITS; SEMICONDUCTORS); as selective reducing agents; as monomers; and as

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elastomer intermediates (see ELASTOMERS, SYNTHETIC). Not least is the use of these materials as intermediates for production of other silanes and silicones.

The inorganic silanes of commercial importance include silane, dichlorosilane, and trichlorosilane. The last, trichlorosilane, is preponderant. It is not only the preferred intermediate for the first two, but it is also used in the production of high purity silicon metal and as an intermediate for silane adhesion promoters, coupling agents, silicone resin intermediates, and surface treatments. Other silanes that appear to have potential in solar electronics are monochlorosilane, disilane, and some silylmetal hydrides. Silicon-based thin films (qv) employed in microelectronic applications are described as hydrogenated amorphous silicon (a-Si-H). An understanding of the physical and chemical behavior of simple silicon compounds, both as precursors and models, is essential for microelectronic device fabrication. Analogously, hydrogenated amorphous silicon carbide is of interest as a wide-gap solar cell material. Siloxene [27233-73-4],  $(H_6Si_6O_3)_x$ , an inorganic polymer containing silicon hydride bonds, is of interest as a catalyst and as a model for luminescent porous silicon (4) (see METAL-CONTAINING POLYMERS (SUPPLEMENT); SOLAR ENERGY).

**Physical Properties.** Silanes and chlorosilanes have boiling points, melting points, and dipole moments comparable to those of simple hydrocarbons (qv) and chlorinated hydrocarbons. Moreover, both silanes and hydrocarbons are colorless gases or liquids at room temperature. The similarity ends, however, with these simple physical characteristics (5). Silane, chlorosilane, disilane, and trisilylamine are pyrophoric, igniting immediately on contact with air. The chlorosilanes react with moist air, liberating hydrogen chloride. Dichlorosilane hydrolyzes to a polymeric material that may ignite spontaneously. Even trichlorosilane is highly flammable. The ability of chlorosilanes to permeate or solvate materials of construction, coupled with their hydrolysis to corrosive hydrogen chloride, formation of abrasive silica, and ability to act as reducing agents, makes these compounds difficult to handle.

The simple inorganic silanes are similar to carbon in that each forms stable, covalent, single bonds. Double bonds involving silicon and silicon carbon are relatively unstable. Whereas examples of isolable silicon double-bond-containing materials have been reported (6,7), these do not constitute a part of industrial silane technology. Most silane materials have a tetrahedral bonding geometry consistent with formation of  $sp^3$  hybrid orbitals. Although in some cases participation of  $3d$  orbitals in five- or six-coordinate silicon compounds, eg,  $SiF_6^{-2}$ , has been invoked, the degree of participation is debated. Silicon is more electropositive than hydrogen and carbon, generally leading to a more polar bond structure than that which occurs in the carbon analogues. The expected inductive release of electrons from  $R_3Si$ , however, does not occur. Disiloxanes, for example, are less basic than ethers. A factor which may contribute to the greater reactivity of silicon compared to that of carbon is silicon's greater size.

The physical and thermodynamic properties of silane in the context of semiconductor applications have been reviewed in detail (8). Tabulations of properties of various silanes in the context of inorganic chemistry have also been published (9). Table 1 contains selected physical properties of inorganic silanes.

**Thermal Properties.** Silanes have less thermal stability than hydrocarbon analogues. The C-H bond energy in methane is 414 kJ/mol (98.9 kcal/mol); the